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REPORT OF INVESTIGATIONS OF SKIPJACK AND TUNA RESOURCES

SPECIAL SCIENTIFIC REPORT: FISHERIES No. 17

UNITED STATES DEPARTMENT OF THE INTERIOR

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United States Department of the Interior
Oscar L. Chapmen, Secretary
Fish and Wildlife Service
Albert M. Day, Director

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No. 17

REPORT OF INVESTIGATIONS OF SKIPJACK AND TUNA RESOURCES IN 1947

By

Nakamura Research Staff 1/

Translated from the Japanese language by

W. G. Van Campen

Pacific Oceanic Fishery Investigations

CONTENTS

	Page
Preface	
Morphometric data on skipjack from the Omaezaki area.	1
Skipjack resources of the Satsunan area	6

1/ Fisheries Experimental Station March 1949.

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Report of Investigations of Skipjack and Tuna Resources in 1947

Nakamura Research Staff

A number of studies of skipjack were made during this year. No investigations of tuna could be carried out because of the inadequacy of research vessel facilities.

Part I is a study of the catch from the waters off Omaezaki, while Part II consists of data on the fishing grounds of the Satsunan Area which were collected at Aburatsu.

I Morphometric Data on Skipjack (Katsuwonus pelamis) from the Waters Adjacent to Omaezaki

Between August and the middle of October of 1948 length and weight data were collected on about 1,200 skipjack taken from the waters adjacent to (in the vicinity of 30 miles SSW of) Omaezaki in Shizuoka Prefecture. On about 60 of these specimens fin ray counts, gill raker counts, and sixteen other determinations were made. The measurements were made along a straight line between two points by the use of calipers, and readings were taken to the nearest millimeter. The body length used was the fork length, that is the straight line distance from the tip of the snout to the point of intersection of the posterior edges of the upper and lower lobes of the caudal fin. The data on the fork lengths and the body weights are shown in Table 3. According to the fishermen the fish which are taken in August and September are either fish resident on shoals or are members of northbound migratory schools, while the fish taken in October are from schools which are moving southward. The data shown in Tables 1 and 2 (Table 2 shows only a part of the measurements) have been combined on the assumption that all of the fish belonged to a single ecological and taxonomic group, that is to say, they show only their characteristics as Katsuwonus pelamis. The following cautions are given with regard to the data in Table 1. Depending on the individual, the most posterior spine of the first dorsal may be completely separated from the spine anterior to it with no membrane visible between the two spines. It is not clear at present whether this is an individual variation or whether it is the result of damage to the fin membrane. Again depending on the individual fish, it is difficult in many cases to distinguish the first dorsal finlet from the rays of the second dorsal fin, and since the same difficulty is encountered with the anal finlets and the rays of the anal fin, the number for both of these counts can be found more accurately on these specimens by adding together the counts for the fin rays and the finlets. In the case of the gill raker count, also, it would be most suitable to count the upper and lower limbs separately, but in actual practice this is almost impossible and so the figures given represent the sum of the gill rakers on both limbs of the arch. (Persons who carried on the investigation -- Katsuzō Kuronuma, Takeichirō Kafuku, and Shōji Kogawa.)

Table 1 Fin ray and gill raker counts of skipjack (Katsuwonus pelamis) taken in the waters adjacent to Omaezaki in Izu between August and October of 1947

First Dorsal Spines

	Dorsal Fin Spines				Separate Spines		Total			
Number of Spines	13	14	15	16	0	1	14	15	16	17
Number of Fish	1	3	52	10	43	23	1	39	23	3

Second Dorsal Rays and Finlets

	Rays			Finlets			Total		
Number of Rays	13	14	15	8	9	10	22	23	24
Number of Fish	6	54	6	3	61	2	7	53	6

Anal Rays and Finlets

	Rays			Finlets				Total			
Number of Rays	13	14	15	6	7	8	9	20	21	22	23
Number of Fish	11	53	2	1	0	64	1	1	11	52	2

Pectoral Rays

Number of Rays	24	25	26	27	28	29	30	31	32
Number of Fish	3	0	9	30	19	3	1	0	1

Number of Gill Rakers on First Left Arch

Number of Rakers	44	45	46	47	48	49	50	51	52	53	54	55	56	57
Number of Fish	1	0	0	1	0	0	2	1	5	7	8	13	9	7

Number of Rakers	58	59	60	61
Number of Fish	7	1	3	1

Table 2 Variations in five body measurements accompanying the growth of skipjack (Katsuwonus pelamis) taken from the waters adjacent to Omaezaki in Izu. Each of these measurements is shown in terms of thousandths of the body length, and for each 50-mm length group the maximum, minimum, and average (in parentheses) values are shown.

Maximum and Minimum Lengths (mm) and Number of Fish Measured (in parentheses)	Head Length	Snout Length	Length of Upper Jaw	Body Width	Body Depth
501-531 (6)	303-320 (315.0)	94-102 (98.2)	114-124 (119.4)	199-211 (206.8)	269-297 (278.3)
462-492 (9)	310-329 (317.1)	95-105 (99.4)	116-127 (121.0)	197-225 (209.1)	266-302 (284.7)
407-441 (8)	310-320 (313.2)	88-96 (93.3)	111-118 (115.1)	182-205 (196.5)	260-289 (273.2)
351-398 (9)	298-318 (306.5)	88-99 (92.9)	107-118 (112.2)	179-202 (189.3)	264-294 (283.7)
302-347 (9)	296-309 (302.3)	86-92 (87.7)	106-114 (110.5)	176-196 (179.5)	251-330 (281.3)
284-299 (3)	299-308 (304.3)	84-95 (88.6)	——	——	——
241 (1)	291 (291)	79 (79)	104 (104)	154 (154)	237 (237)

Table 3 Body lengths (fork lengths) and weights of skipjack (Katsuwonus pelamis) taken from the waters adjacent to Omaezaki in Izu between August and October 1947. The lengths are in cm, the weights are in kilograms, and the figures represent the number of individuals.

Fork Length / Date	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
August 3-13											1		1							8	10
August 16-31	1								1		1	2	3	3	6	6	13	3	1	5	1
Sept. 5 - 13				1	2					1	4	4	8	24	40	55	46	23	6	5	4
Sept.19 - 29	2								2		2		4	3		5	7	5		2	5
October 3-14															2	2		2	6	3	4

Fork Length / Date	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	Total
August 3-13	5	13	5	2	5	9	15	24	35	29	13		2									177
August 16-31	1	4	5	2	4	4	5	14	30	68	36	20	9									248
Sept. 5 - 13	4		2			4	6	10	12	6	5	3										278
Sept.19 - 29	5		7	5	8	12	13	21	33	35	31	16	17	8	3	2			1		1	253
October 3-14	2	1	2	1	2	2	4	15	38	51	61	37	29	12	11	5	2					294

Table 3 (continued)

Body Weight / Date	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9
August 3 - 13					1	1		1		1		1	6	4	2	12	2	4
August 16 - 31				1	2	3	2	9	17	7	1	4	2	1	1	2	3	3
September 5 - 13	2	1	2	5	5	8	32	52	50	43	7	3	6	3	1		1	3
September 19 - 29		1	1	3	6	6	1	3	7	4	3		1	3	3	8	6	1
October 3 - 14							1	1	5	1	4	5	4	3	1	1	1	4

Body Weight / Date	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
August 3 - 13	6	7	6	6	9	14	15	22	21	12	8	4		1	1			
August 16 - 31	4	2	5	4	5	6	4	16	24	32	37	20	12	8	4	2	1	1
September 5 - 13		1	3	3	1	4	2	3	7	3	6	7	1	3		1	1	
September 19 - 29	4	2	6	9	15	16	24	29	30	24	31	20	19	8	5	6	6	6
October 3 - 14		1	2	1	2	1	3	8	11	20	8	29	16	22	16	20	8	11

Body Weight / Date	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	Total
August 3 - 13														167
August 16 - 31	1													246
September 5 - 13														269
September 19 - 29	2	5	1											325
October 3 - 14	12	8	2	3	1		2	2			1		1	241

II An Investigation of the Skipjack Resources of the Satsunan Area

(a) Because there was no research vessel available, these data were gathered aboard commercial fishing boats.

(b) Measurements of fresh fish were made at the Aburatsu fish market, and observations requiring dissection of the fish were made at dried fish-stick factories.

(c) Reports of statistical data were obtained from the Fisheries Associations of Kagoshima and Miyazaki prefectures, and the figures were verified insofar as possible by field trips to those areas.

(d) At Aburatsu and vicinity certain boats were assigned the duty of reporting on the fishing situation, and reports on the designated subjects were obtained from these vessels at the conclusion of each fishing trip.

Data

(a) The skipjack fishing situation in the Satsunan Area in 1947 (for boats from Miyazaki Prefecture)

The first catch was made near the Shichitō by the Shōei Maru on March 5 when 200 kan [1 kan = 8,27 pounds] were taken near Suwaseshima [29°38'N, 129° 43'E]. On March 8 a few fish were caught at Gogōzone [29° 30' N, 129° 5' E], and on March 12 500 kan were taken at Gajanishizone [29° 55' N, 128° 50' E]. The final fishing of the season was done in the waters adjacent to the Shichitō and at Torishima [27° 52' N, 128° 14' E]. Throughout the whole season the principal fishing grounds were around the Shichitō and on the shoals west of the Amami group, but a peculiar phenomenon was the appearance during a period of about two weeks beginning in the middle of May of dense schools of fish which took the bait extremely well and which remained about 8 miles south of the Yakushima lighthouse [30° 20' N, 130° 30' E] providing very good fishing. If we consider the season from the point of view of the various classes of boats which were fishing, the larger vessels gradually came into operation from the early part of March and were almost all fishing by the end of the month. The majority of them continued to fish until the middle of November and a few operated until the first part of December. The peak of the season was from the middle of April until early June during which period more than two-thirds of the year's catch was taken. Four of the larger vessels fished in the Sanriku Area [Northeastern Japan] from August to October, and their catch has been eliminated from the statistics.

At the beginning of the season the smaller boats kept an eye on the activities of the larger vessels and began to operate only after it had become clear that the season was under way in the Tokara Is. area [29° 37' N, 129° 43' E]. Consequently their season began in the first part of April, was at its peak from April to June, and generally ended early in November. The peak season for the smaller boats in the southern part of the prefecture is during the period when the schools migrate into the northern part of the Shichitō, the eastern part of the Ōsumi Kaikyō, and the waters adjacent to the Hyūga Nada. The boats from the northern part of the prefecture - Kadogawa, Taina [? 鯛名], Todoro, Shimanoura - operate in the same waters as those from the southern part of the prefecture during the early part of the season, but from July to September most of them fish off their home ports or in the waters west of Ashizurimisaki in Shikoku. (Table 1)

(b) Skipjack catch

The landings for the main ports of Miyazaki and Kagoshima prefectures for 1947 are shown in Tables 2 and 3. The figures on the Miyazaki Prefecture landings are thought to be fairly complete, but in the case of Kagoshima Prefecture the landings for Kagoshima City, which is the main port for landing skipjack in the prefecture, were not obtained and other landings not included in the statistics are thought to have reached a considerable amount. Therefore it is thought that the actual landings for that prefecture were over three times the figure given in this report.

(c) Fish catch statistics

Tables 4 and 5 show past skipjack catches and the monthly catches for 1947 from figures supplied by the statistical departments of the prefectural governments of Miyazaki and Kagoshima.

(d) Measurements of skipjack

i. Size composition. The size composition of the sample of 317 fish measured during this year is shown in Table 6. By comparison with the catches made in areas other than the Satsuman Area, the proportion of large-sized fish is very great. The values also differ from those obtained in past investigations as reported by Kimura [1]. It is not clear whether this is due to the small number of measurements which we made or whether it reflects a phenomenon peculiar to this year.

ii. Table 7 shows the sex ratio and data on the length variation between the sexes for the 317 specimens.

iii. Gonad weights and egg counts are shown in Table 8. Further work is being done at present on this aspect of the investigation.

(e) Food habits study

The small amount of data which we collected on the contents of the digestive tracts of skipjack is shown in Table 9.

(f) The period at which juvenile fish appear and their ecology

Observations of the fish landed at the Aburatsu fish market showed that the catch from the waters adjacent to Takarajima [29° 9' N, 129° 13' E] and Gajashima [29° 54' N, 129° 33' E] from early October to the middle of November contains a good many individuals having a total length of 26 - 43 cm (weight 240 - 1,335 gr). Yabe had an opportunity to observe the ecology of small skipjack from a fishing boat in the Tokara group and at Torishima between September 25 and October 4, and on this cruise about 300 small fish measuring 26-43 cm in total length were taken at several different fishing grounds in the vicinity of Gajanishisone and Takarajima. (Table 10). When these small skipjack are caught no medium or large skipjack are taken along with them, the

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(1) Kimura, Kinosuke. Dissertations on the Situation in the Fisheries for Important Japanese Species [Naichi Jūyō Gyorui Gyokyō Ron], First Edition, 1941 , p. 9.

only mixed catch being a certain number of dolphin, Coryphaena hippurus, 40-60 cm long. From this fact it is thought that these small fish do not mingle with the schools of large fish but school separately. This year's experience indicates that these small skipjack are more numerous on shoals comparatively close to islands, but nothing definite can as yet be said on this point. (Persons who carried on the investigation - Hiroshi Yabe, Tokumi Mori, and Yoshio Kurowaki)

Table 1 Skipjack fishing seasons and main fishing grounds (1947 - boats from Miyazaki Prefecture)

	Beginning of Season		Peak of Season		End of Season	
Type of Boat	Time	Fishing Ground	Time	Fishing Ground	Time	Fishing Ground
large boats	early March	near Suwaseshima (Tokara Is.)	April - early June	south of Yaku-shima and near Tokara Is.	early December	near Okinawa Is.
small boats	early April	near Tokara Is.	April to June	near Tokara Is.; south of Yaku-shima; Hyūga Nada	early November	near Tokara Is.

Notes: 1. Over 50 tons are large boats, under that are small boats.

2. Fishing grounds in the Okinawa Is. are principally around Kumeshima, Torishima, and the Iheya chain and on the shoals of those areas.

3. Some of the boats from the northern part of the prefecture fish in the adjacent waters of the Tokara Is. in the early part of the season, but most of them operate off their home ports (in the Hyūga Nada) and in the waters southwest of Ashizurimisaki.

4. Some large boats operated in the Sanriku Area from August to October.

Table 2 Landings by ten-day periods in Miyazaki Prefecture for 1947 (in units of kan)

Date	Place	Fukushima	Kanaya	Sotonoura	Sakamatsu	Meizu
January	first 10 days					
	second 10 days	———				
	third 10 days					
February	first 10 days					
	second 10 days					
	third 10 days					
March	first 10 days					
	second 10 days					
	third 10 days					
April	first 10 days	628		2,421	10,225	831
	second 10 days			15,112		7,524
	third 10 days	2,683	330	5,289		13,112
May	first 10 days	965	222	13,993	14,035	6,366
	second 10 days	1,487	965	8,706		14,962
	third 10 days	2,418	1,170	8,736		15,232
June	first 10 days	422	831	9,227	4,995	20,202
	second 10 days	281	88	3,480		8,849
	third 10 days		120	2,157		2,379
July	first 10 days	946	77	2,009	411	2,484
	second 10 days	183		1,733		1,379
	third 10 days	681		2,811		2,298
August	first 10 days	628		1,840	336	0
	second 10 days					0
	third 10 days					1,165
September	first 10 days			168	404	223
	second 10 days					110
	third 10 days			3,045		2,140
October	first 10 days			181	3	90
	second 10 days					
	third 10 days					
November	first 10 days			672	15	
	second 10 days					
	third 10 days					
December	first 10 days				168	
	second 10 days					
	third 10 days					
Totals		11,322	3,803	81,580	30,622	99,346

Notes:

1. These figures are based on the reports of the local fisheries associations.

2. Landings of fish taken while operating in the Sanriku Area have been omitted.

Table 2 (continued)

Date	Place	Daidōzu	Aburatsu	Kadogawa	Todoro	Shimanoura	Monthly Totals
January	first 10 days						
	second 10 days						
	third 10 days						
February	first 10 days						
	second 10 days						
	third 10 days						
March	first 10 days						
	second 10 days		720				6,311
	third 10 days		5,411				
April	first 10 days		4,116				
	second 10 days	6,850	31,753				155,893
	third 10 days	15,620	39,369				
May	first 10 days	27,563	31,410	751	158	34	
	second 10 days	41,649	45,106	7,920	121	257	352,767
	third 10 days	37,154	58,572	11,879	544	392	
June	first 10 days	37,310	58,474	1,769		542	
	second 10 days	9,084	11,388	2,404			191,765
	third 10 days	4,735	11,489	1,539			
July	first 10 days	3,386	22,033	0			
	second 10 days	1,350	17,594	1,954			83,705
	third 10 days	3,558	14,347	2,527	10	1,934	
August	first 10 days	3,584	9,348			1,084	
	second 10 days	976	2,247			0	25,632
	third 10 days	0	4,417			7	
September	first 10 days	0	1,983		378	524	
	second 10 days	2,489	716		179	0	18,362
	third 10 days	432	5,130		305	136	
October	first 10 days	980	2,952		44		
	second 10 days	303	2,828				13,453
	third 10 days	0	6,072				
November	first 10 days	540	6,116				
	second 10 days		476				7,819
	third 10 days		0				
December	first 10 days		379				
	second 10 days						547
	third 10 days						
Totals		197,563	394,446	30,743	1,739	4,910	856,074

Notes:

1. These figures are based on the reports of the local fisheries associations.
2. Landings of fish taken while operating in the Sanriku Area have been omitted

Table 3 Skipjack Landings by Ten-Day Periods At the Major Fishing Ports of Kagoshima Prefecture in 1947 (in units of kan)

Place / Period		Makurazaki	Yamagawa	Bō Anchorage	Monthly Totals
January	first				
	second				
	third				
February	first				
February	second				
	third				
March	first				
	second	242	4,658	508	6,440
	third	1,022			
April	first	7,023			
	second	14,731	70,607	16,895	128,755
	third	19,499			
May	first	9,094			
	second	1,772	72,900	32,999	127,675
	third	10,910			
June	first	5,060			
	second	3,442	35,762	6,662	54,787
	third	3,861			
July	first	1,350			
	second	1,737	25,503	8,635	41,355
	third	4,150			
August	first	1,402			
	second	789	28,723	6,997	38,320
	third	409			
September	first	1,067			
	second	82	14,181	2,941	20,302
	third	2,031			
October	first	3,098			
	second	1,115	14,596	3,122	22,740
	third	809			
November	first	628			
	second	509	9,218	2,523	13,090
	third	212			
December	first	12			
	second	18		530	599
	third	39			
Totals		96,093	276,158	81,812	454,063

1. These figures are from the statistics on the fish handled by the various local fisheries associations.

2. The actual total landings are thought to amount to at least three times the figures given here.

Table 4 Skipjack Landings (compiled by the Fisheries Departments of the prefectural governments in units of kan)

Year	1930	1931	1932	1933	1934	1935	1936	1937
Prefecture								
Miyazaki	116,905	179,007	226,747	306,422	237,978	123,271	299,927	415,823
Kagoshima		U N K N O W N						

Year	1938	1939	1940	1941	1942	1943	1944	1945
Prefecture								
Miyazaki	333,208	316,304	423,668	949,543	1,454,754	761,991	647,813	204,357
Kagoshima		U N K N O W N						

Year	1946	1947
Prefecture		
Miyazaki	463,357	844,203
Kagoshima		1,193,282

Table 5 Monthly Catches of Skipjack for 1947 (compiled by prefectural fisheries departments, in units of kan)

Month / Prefecture	January	February	March	April	May	June	July	August
Miyazaki	678	0	3,739	147,687	318,305	225,958	60,920	31,835
Kagoshima	1,500	0	12,075	292,520	213,055	160,316	75,555	78,580

Month / Prefecture	September	October	November	December	Totals
Miyazaki	15,647	20,296	13,625	5,513	844,203
Kagoshima	98,171	109,915	99,319	47,276	1,193,282

Table 6 Size Composition of Skipjack Sample (1947)

	Special Large	Large	Medium	Small
Number of fish	47	232	38	43
Percentage	13.1	64.4	10.6	11.9

Notes:

1. Special Large . . . over 2 kan ($\geq$7.50 kg), Large . . . 1 - 2 kan (3.75 - 7.50 kg), Medium . . . 500 momme - 1 kan (1.87 - 3.75 kg), Small . . . under 500 momme ($\leq$1.87 kg).
2. These figures are based on rough measurements of fish at the Aburatsu dried fish-stick factories.
3. Measurements were taken on eight different occasions from April to October, 1947, and involved a total of 317 fish.

Table 7 Sex Ratios and Variations in Body Length Between the Sexes

Date Examined	Number of Fish Examined	Sex		Maximum Length (cm)		Minimum Length (cm)	
		Female	Male	Female	Male	Female	Male
4-2-47	48	7	41	58	64	56	48
4-22-47	50	29	21	59	58	37	46
5-5-47	49	27	22	61.5	61.5	48	51.5
5-27-47	50	11	39	59	60	40.5	39.5
9-9-47	30	14	16	60	60	52	52
10-14-47	30	25	5	62	69	51	35
10-18-47	30	14	16	65	67	53	50.5
11-21-47	30	14	16	74	72	65	67.5
Totals	317	44.4%	55.6%				

Note: These data were collected at the Aburatsu dried fish-stick factories.

Table 8 Gonad Weights and Egg Counts

Specimen No.	Sex	Body Length cm	Body Weight kg	Gonad Weight g	Number of Ova in Ovaries		
					Right	Left	Total
1	male	55.5	4.16	65.5			
2	female	52.0	3.75	127.5			
3	female	57.5	5.18	45.5			
4	male	48.5	3.04	161.5			
5	female	54.5	4.50	119.0	309,597	255,540	565,137
6	male	62.5	6.98	157.5			
7	female	60.0	6.45	137.0			
8	female	48.0	3.04	53.0			
9	male	56.0	4.95	251.5			
10	female	61.0	5.96	148.9	457,597	392,485	850,082

Notes: 1. Data collected August 2, 1947 at the Aburatsu market.

2. The lengths and weights are those of fresh fish.

3. The gonad weights are taken from material preserved in formalin.

Table 9 Contents of digestive tracts of skipjack (fixed in formalin about 30 minutes after capture by the Kaikō [?Uminosachi] Maru at Nakasone [28° 10' N, 129° 15' E] August 22, 1947)

Specimen No.	Contents	Number	Smallest mm	Largest mm	Notes
1	Scomber tapeinocephalus ?	6	83	112	
2	Engraulis japonicus (chum bait)	1	70		
	Scomber tapeinocephalus ?	2			half-digested
	Hepatus ?	1	33		half-digested
	unidentified fish (Apogonidae?)	2	27	36	
3	Trachurus japonicus (chum bait)	1	100		
	small squid	2			half-digested
4	Engraulis japonicus (chum bait)	about 30	about 70	about 91	half-digested
	Trachurus japonicus (chum bait)	1	120		
	Balistes sp.	1	27		
	unidentified fish	1	about 100		half-digested
5	Engraulis japonicus (chum bait)	3	about 120	about 130	
	Trachurus japonicus (chum bait)	1	about 110		
	Megalopa	1			
6	Monacanthidae	1	26		
	small shrimp	2			

Table 10 Measurements of Small Skipjack

Serial Number	Total Length cm	Body Length cm	Body Weight gr
1	26.0	22.7	240
2	28.0	25.5	330
3	30.0	28.5	431
4	31.5	29.0	476
5	33.0	30.0	491
6	31.5	29.0	498
7	32.0	29.0	506
8	32.0	29.5	517
9	33.0	30.0	543
10	32.0	29.5	547
11	33.0	30.0	547
12	33.0	30.0	562
13	33.0	30.0	562
14	32.5	30.0	570
15	32.5	30.0	573
16	32.0	29.5	577
17	30.2	29.5	577
18	33.5	30.5	577
19	31.0	30.0	581
20	33.0	30.0	585
21	34.0	30.5	596
22	32.0	30.0	604
23	33.0	31.0	615
24	34.0	31.0	615
25	33.0	30.5	619
26	34.0	30.0	619
27	34.0	31.0	683
28	34.0	31.5	683
29	39.5	36.0	1,005
30	41.0	38.0	1,121
31	43.0	39.5	1,335

Notes: 1. Measurements taken at the Aburatsu fish market October 8, 1947.

2. Fish caught October 1, 1947.

3. Fish taken west of Takarashima in the Tokara Group.

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